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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/670,083	09/23/2003	Changsheng Xu	ALBAN13.007C1	6312

20995 7590 03/24/2006

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EXAMINER	
KIM, PAUL	

ART UNIT	PAPER NUMBER
2161	

DATE MAILED: 03/24/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/670,083	XU ET AL.	
	Examiner	Art Unit	
	Paul Kim	2161	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *23 September 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-25* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-25* is/are rejected.

7)☒ ~~Claim(s) *14,16,18 and 20* is/are objected to~~.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *23 September 2003* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☒ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☒ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

SAM RIMELL
PRIMARY EXAMINER

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *1 March 2004*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

1. This action is responsive to the following communication: CIP application filed on 23 September 2003.

2. Claims 1-25 are pending. Claims 1, 14, and 16-25 are independent.

Priority

3. Acknowledgment is made of applicant's claim for foreign priority based on an application filed in Singapore on 23 March 2001. It is noted, however, that applicant has not filed a certified copy of the continuation application as required by 35 U.S.C. 119(b).

Oath/Declaration

4. The oath or declaration is defective. A new oath or declaration in compliance with 37 CFR 1.67(a) identifying this application by application number and filing date is required. See MPEP §§ 602.01 and 602.02.

The oath or declaration is defective because it does not identify the foreign application for patent or inventor's certificate on which priority is claimed pursuant to 37 CFR 1.55, and any foreign application having a filing date before that of the application on which priority is claimed, by specifying the application number, country, day, month and year of its filing.

Drawings

5. New corrected drawings in compliance with 37 CFR 1.121(d) are required in this application because the reference numerals have been handwritten in and are illegible (e.g. Reference numeral 90 of Figure 8; and Reference numeral 94 of Figure 12). Applicant is advised to employ the services of a competent patent draftsperson outside the Office, as the U.S. Patent and Trademark Office no longer prepares new drawings. The corrected drawings are required in reply to the Office action to avoid abandonment of the application. The requirement for corrected drawings will not be held in abeyance.

6. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they include the following reference character(s) not mentioned in the description:

- Reference numeral 52 of Figure 3; and
- Reference numeral 68 of Figure 5.

Corrected drawing sheets in compliance with 37 CFR 1.121(d), or amendment to the specification to add the reference character(s) in the description in compliance with 37 CFR 1.121(b) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Objections

7. Claims 14, 16, 18 and 20 are objected to because of the following informalities:

As per claims 14 and 16, "whrein" is misspelled. Appropriate correction is required.

As per claim 18, the semi-colon is incorrectly placed after "and" in subsection b. Appropriate correction is required.

As per claim 20, the semi-colon is incorrect placed after "and" in line 11 of the claim. Appropriate correction is required.

Claim Rejections - 35 USC § 102

8. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

SR 9. **Claims 1, 8, and 13** AMD 23 are rejected under 35 U.S.C. 102(b) as being anticipated by Blum et al (U.S. Patent No. 5,918,223, hereinafter referred to as BLUM), filed on 21 July 1997, and issued on 29 June 1999.

10. **As per independent claim 1**, BLUM teaches:

> A method of representing audio/musical information in a digital representation suitable for use in content-based information indexing and retrieval, the method comprising:
>
> a) determining a first representation including a set of peaks and valleys corresponding to maximum and minimum values respectively of at least one characteristic of the audio/music {See BLUM, Figure 4; col. 6, lines 24-28, wherein this reads over "[t]he analysis method will compute new arrays of data

values (called trajectories), specifying . . . pitch"; and col. 9, lines 1-41, wherein this reads over "[t]he magnitude spectrum is analyzed to find the peaks"}; and

b) determining a second representation including values representing relative differences between the determined peaks and valleys {See BLUM, col. 8, wherein this reads over "PITCH-TRAJECTORY CLEANUP routine will look over the entire pitch trajectory and smooth the data while removing bad data points"}.

11. **As per dependent claim 8**, BLUM teaches:

A method as claimed in claim 1, wherein the audio/musical information is an acoustic signal {See BLUM, col. 3, lines 4-5, wherein this reads over "measures a variety of acoustical features of each sound file"}.

12. **As per dependent claim 13**, BLUM teaches:

A method as claimed in claim 1, wherein the characteristic of the audio/music is any one or more of the following:

volume level;
pitch {See BLUM, Figure 4; col. 6, lines 24-28, wherein this reads over "[t]he analysis method will compute new arrays of data values (called trajectories), specifying . . . pitch"; and
interval information.

Additionally, because the "volume level" and "interval information" were optionally recited within the claim (i.e. "the characteristic of the audio/music is any one or more of the following"), they do not carry any patentable weight.

13. **As per independent claim 23**, BLUM teaches:

A system for representing audio/musical information in a digital representation suitable for use in content-based information indexing and retrieval, the system comprising:

means for determining a first representation including a set of peaks and valleys corresponding to maximum and minimum values respectively of at least one characteristic of the audio/music {See BLUM, Figure 4; col. 6, lines 24-28, wherein this reads over "[t]he analysis method will compute new arrays of data values (called trajectories), specifying . . . pitch"; and col. 9, lines 1-41, wherein this reads over "[t]he magnitude spectrum is analyzed to find the peaks"}; and

means for determining a second representation including values representing relative differences between the determined peaks and valleys {See BLUM, col. 8, wherein this reads over "PITCH-TRAJECTORY CLEANUP routine will look over the entire pitch trajectory and smooth the data while removing bad data points"}.

14. **Claim 17** is rejected under 35 U.S.C. 102(b) as being anticipated by Ghias et al (NPL, "Query By Humming," Proc ACM Multimedia 95, San Francisco, hereinafter referred to as GHIAS).

15. **As per independent claim 17**, GHIAS teaches:

A method of retrieving audio/music information from a music score database, by matching query keywords with database keywords, the method comprising:

a) comparing a query keyword, created from an acoustic input for retrieval of music information in a music score database, with a global feature corresponding to each music score to eliminate non-relevant database keywords {See GHIAS, p. 4, Para. 5-11, wherein this reads over "[s]ongs in the database are preprocessed to convert the melody into a stream of U, D, S characters. and the converted user input is compared with all the songs"};

b) comparing the second representation of the query with the second representation of each database keyword {See GHIAS, p. 4, Para. 5-11, wherein this reads over "[s]ongs in the database are preprocessed to convert the melody into a stream of U, D, S characters, and the converted user input is compared with all the songs"}; and

c) comparing the histogram of the first representation of the query with the histogram of the first representation of each database keyword {See GHIAS, p. 4, Para. 5-11, wherein this reads over "[s]ongs in the database are preprocessed to convert the melody into a stream of U, D, S characters, and the converted user input is compared with all the songs"}.

Claim Rejections - 35 USC § 103

16. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

17. **Claims 2, 3, 5, 10, and 11** are rejected under 35 U.S.C. 103(a) as being unpatentable over BLUM, in view of Yourlo (U.S. Patent No. 6,201,176, hereinafter referred to as YOURLO), filed on April 21, 1999, and issued on March 13, 2001.

BLUM teaches the limitations of claims 1, 8, and 13 for the reasons stated above.

BLUM differs from the claimed invention in that BLUM fails to disclose a method for determining a histogram of representations of peaks and valleys (claims 2 and 5).

BLUM differs from the claimed invention in that BLUM fails to disclose a method for subjecting the digital signal to pitch detection, and subsequently the pitch detected signal to interval or note detection (claims 10 and 11).

18. **As per dependent claims 2 and 5**, BLUM, in combination with YOURLO, discloses the method, further including determining a histogram of the first and second representations {See YOURLO, Figures 11 and 12; and col. 9, lines 46-48, wherein this reads over "[f]rom these resulting pitches, a histogram of dominant pitches present in the original music is formed"}.

The combination of inventions disclosed in BLUM and YOURLO would disclose a method of determining a histogram of the first and second representations. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the above invention suggested by BLUM by combining it with the invention disclosed by YOURLO.

One of ordinary skill in the art would have been motivated to do this modification so that the histograms may be used in subsequent searching.

19. **As per dependent claim 3**, BLUM, in combination with YOURLO, discloses the method, wherein the histogram of the first representation includes a representation of, the population, or duration, of peaks or valleys in a given time interval {See YOURLO, Figures

11 and 12; col. 8, lines 58-63, wherein this reads over "represented in the form of a histogram covering the entire period of interest for the signal being considered"}.

The combination of inventions disclosed in BLUM and YOURLO would disclose a method, wherein the first representation includes a representation of peaks or valleys in a given time interval. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the above invention suggested by BLUM by combining it with the invention disclosed by YOURLO.

One of ordinary skill in the art would have been motivated to do this modification so that the histograms may contain relevant pitch information for searching.

20. **As per dependent claim 10**, BLUM, in combination with YOURLO, discloses:

A method as claimed in claim 8, further including preprocessing the acoustic signal before performing a), wherein the pre-processing includes:

converting the acoustic signal to a digital signal {See BLUM, col. 1, lines 58-61, wherein this reads over "[t]his stream of sound might be a real-time input to a computer system, as from a microphone"};

removing noise from the digital signal {See BLUM, col. 14, lines 8-20, wherein this reads over "Phase 2: Pitch Trajectory Filtering" and "[a]nother typical error in the pitch estimation is due to noise . . . . The second phase of the cleanup algorithm looks over 11 frames of the pitch trace, sorts the pitch estimates . . ."};

subjecting the noise free digital signal to pitch detection {See YOURLO, Figures 6A-C; col. 5, line 67-col. 6, line 5, wherein this reads over "[a]fter windowing the input music signal, the signal in each time window is processed by a Fast Fourier Transform process to form an output signal"}; and

subjecting the pitch detected digital signal to interval or note detection {See YOURLO, col. 9, lines 30-49, wherein this reads over "[t]he localized pitch is determined over a small window", "the filters are spaced at intervals determined by the rate at which the original musical signal was sampled. The sampled signal is filtered through the filter bank, and the comb filter that has the greatest output power will have a resonant frequency corresponding to the dominant pitch over the window"}.

The combination of inventions disclosed in BLUM and YOURLO would disclose a method of preprocessing the acoustic signal. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the above invention suggested by BLUM by combining it with the invention disclosed by YOURLO.

One of ordinary skill in the art would have been motivated to do this modification so that the acoustic signal may be appropriately analyzed for note detection.

21. **As per dependent claim 11**, BLUM, in combination with YOURLO, discloses a method, wherein the pitch detection includes a windowed Fourier transform {See YOURLO, Figures 6A-C; col. 5, line 67-col. 6, line 5, wherein this reads over "[a]fter windowing the input music signal, the signal in each time window is processed by a Fast Fourier Transform process to form an output signal"} and auto-correlation {See BLUM, col. 6, lines 37-38, wherein this reads over "autocorrelation of each trajectory may be used instead of storing the statistics of its first derivative"} of the noise free digital signal.

The combination of inventions disclosed in BLUM and YOURLO would disclose a method wherein the pitch detection includes a windowed Fourier transform. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the above invention suggested by BLUM by combining it with the invention disclosed by YOURLO.

One of ordinary skill in the art would have been motivated to do this modification in order to parse out noise contained within the digital signal.

22. **Claim 4** is rejected under 35 U.S.C. 103(a) as being unpatentable over BLUM, in view of Miller (U.S. Patent No. 4,813,076, hereinafter referred to as MILLER), filed on 9 June 1987, and issued on 14 March 1989.

BLUM teaches the limitations of claims 1, 8, and 13 for the reasons stated above.

BLUM differs from the claimed invention in that BLUM fails to disclose a method for determining the relative difference values for a peak and a valley (claim 4).

23. **As per dependent claim 4**, BLUM, in combination with MILLER, discloses a method for determining the relative difference values for a peak and a valley according to the difference in magnitude which follows each peak and valley {See MILLER, col. 33, lines 47-55, wherein this reads over "there is a pair, composed of a local minimum and a local maximum for each function at any peak or valley location"}.

The combination of inventions disclosed in BLUM and MILLER would disclose a method for determining the relative difference values for a peak and value. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the above invention suggested by BLUM by combining it with the invention disclosed by MILLER.

One of ordinary skill in the art would have been motivated to do this modification so that the pitch intervals of the audio input may be analyzed and stored for subsequent searching.

24. **Claim 6** is rejected under 35 U.S.C. 103(a) as being unpatentable as applied to claim 1 over BLUM, in view of Varme (U.S. Patent No. 6,831,220, hereinafter referred to as VARME), filed on November 6, 2003, claiming priority to April 6, 2000.

BLUM teaches the limitations of claims 1, 8, and 13 for the reasons stated above.

BLUM differs from the claimed invention in that BLUM fails to disclose a music score (claim 6).

25. **As per dependent claim 6**, BLUM, in combination with VARME, discloses a method wherein the audio/musical information is a music score {See VARME, col. 2, lines 20-22, wherein this

reads "musical notation system for creating colored music scores and colored musical instruments"; and col. 2, lines 41-45, wherein this reads over "music score includes notes which form a musical arrangement"}.

The combination of inventions disclosed in BLUM and VARME would disclose a method wherein the audio information is a music score. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the above invention suggested by BLUM by combining it with the invention disclosed by VARME.

One of ordinary skill in the art would have been motivated to do this modification so that the music score may be entered into a music score database for subsequent pitch searching and matching.

26. **Claim 7** is rejected under 35 U.S.C. 103(a) as being unpatentable as applied to claims 1 and 6 over BLUM, in view of VARME, and in further view of Takenaka et al (U.S. Patent No. 6,807,450, hereinafter referred to as TAKENAKA), filed 5 January 1999, and issued on 19 October 2004.

BLUM differs from the claimed invention in that BLUM fails to disclose a method including the pre-processing of the music score (claim 7).

27. **As per dependent claim 7**, BLUM, in combination with VARME and TAKENAKA, discloses a method including pre-processing the music score before performing step (a) of claim 1, wherein the pre-processing includes removing zero notes from the music score, and adjoining the remaining nonzero notes to fill any gaps left by the removed zero notes {See TAKENAKA, col. 7, lines 47-53, wherein this reads over "[t]he linking function is a function that links a plurality of compressed information pieces by removing a silent portion (that is, a blank portion) between the compressed information pieces"}.

The combination of inventions disclosed in BLUM, VARME, and TANEKA would disclose a method wherein the music score is pre-processed by removing zero notes from the music score. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the above invention suggested by BLUM by combining it with the inventions disclosed by VARME and TANEKA.

One of ordinary skill in the art would have been motivated to do this modification so that the music score may be condensed by removing silent notes, allowing for a search based on pitch.

28. **Claim 9** is rejected under 35 U.S.C. 103(a) as being unpatentable as applied to claims 1 and 8 over BLUM, in view of Wang et al (U.S. Patent No. 6,990,453, hereinafter referred to as WANG), filed on 20 April 2001, and issued on 24 January 2006.

BLUM teaches the limitations of claims 1, 8, and 13 for the reasons stated above.

BLUM differs from the claimed invention in that BLUM fails to disclose a method wherein the acoustic signal is a vocal or humming signal (claim 9).

29. **As per dependent claim 9**, BLUM, in combination with WANG, discloses a method, wherein the acoustic signal is a vocal or humming signal {See WANG, col. 5, lines 55-57, wherein this reads over "Any type of audio, including sound, voice, music, or combinations of types, can be recognized by the present invention"}.

The combination of inventions disclosed in BLUM and WANG would disclose a a method wherein the acoustic signal is a vocal or humming signal. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the above invention suggested by BLUM by combining it with the invention disclosed by WANG.

One of ordinary skill in the art would have been motivated to do this modification so that a user may hum or sing in an audio input for pitch searching and matching.

30. **Claim 12** is rejected under 35 U.S.C. 103(a) as being unpatentable over BLUM, in view of YOURLO, and in further view of Foote (U.S. Patent No. 6,542,869, hereinafter referred to as FOOTE), filed on May 11, 2000, and issued on April 1, 2003.

BLUM teaches the limitations of claims 1, 8, and 13 for the reasons stated above.

BLUM differs from the claimed invention in that BLUM fails to disclose a method wherein the interval or note detection includes logarithmically scaling the pitch detected digital signal (claim 12).

31. **As per dependent claim 12**, BLUM, in combination with YOURLO and FOOTE, discloses a method wherein the interval or note detection includes logarithmically scaling the pitch detected digital signal {See FOOTE, col. 3, line 65 – col. 4, line 9, wherein this reads over "each analysis frame is windowed with a 256-point Hamming window and a Fast Fourier transform is used for parameterization to estimate the spectra components in the window. The logarithm of the magnitude of the result of the FFT is used as an estimate of the power spectrum of the signal in the window"}.

The combination of inventions disclosed in BLUM, YOURLO, and FOOTE would disclose a method wherein the interval or note detection includes logarithmically scaling the pitch detection digital signal with a 256-point Hamming window and a Fast Fourier transform. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the above invention suggested by BLUM by combining it with the inventions disclosed by YOURLO and FOOTE.

One of ordinary skill in the art would have been motivated to do this modification in order to normal the digital signal.

32. **Claims 14, 16, 19, and 25** are rejected under 35 U.S.C. 103(a) as being unpatentable over BLUM, in view of McNab et al (NPL, "Tune Retrieval in the Multimedia Library," University of Waikata, Hamilton, New Zealand, published in 1996, hereinafter referred to as MCNAB), and GHIAS.

BLUM teaches the limitations of claims 1, 8, and 13 for the reasons stated above.

BLUM differs from the claimed invention in that BLUM fails to disclose a method for using keywords to represent audio/musical information, and storing the search keywords in the database (claims 14 and 16).

BLUM differs from the claimed invention in that BLUM fails to disclose a method for converting a music score into score keywords (claims 19 and 25).

33. **As per independent claim 14**, BLUM, in combination with MCNAB and GHIAS, discloses:

> A method of creating a music score database, comprising:
>
> representing an actual music track uniquely with a music score such that there is a link between the music score and the actual music track {See MCNAB, p. 7, Para. 2, wherein this reads over "string matching on the score database in order to retrieve music"};
>
> representing the music score in accordance with a representing method to form search keywords, wherein the representing method is adapted to represent audio/musical information in a digital representation suitable for use in content-based information indexing and retrieval {See GHIAS, p. 4, Para. 5-11, wherein this reads over "[s]ongs in the database are preprocessed to convert the melody into a stream of U, D, S characters, and the converted user input is compared with all the songs"}, the representing method comprising:
>
> determining a first representation including a set of peaks and valleys corresponding to maximum and minimum values respectively of at least one characteristic of the audio/music {See BLUM, Figure 4; col. 6, lines 24-28, wherein this reads over "[t]he analysis method will compute new arrays of data values (called trajectories), specifying . . . pitch"; and col. 9, lines 1-41, wherein this reads over "[t]he magnitude spectrum is analyzed to find the peaks"}; and

determining a second representation including values representing relative differences between the determined peaks and valleys, wherein the audio/musical information is the music score {See BLUM, col. 8, wherein this reads over "PITCH-TRAJECTORY CLEANUP routine will look over the entire pitch trajectory and smooth the data while removing bad data points"}; and

storing the search keywords in a database {See GHIAS, p. 4, Para. 5-11, wherein this reads over "[s]ongs in the database are preprocessed to convert the melody into a stream of U, D, S characters, and the converted user input is compared with all the songs"}.

The combination of inventions disclosed in BLUM, MCNAB, and GHIAS would disclose a method of creating a music score database. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the above invention suggested by BLUM by combining it with the inventions disclosed by MCNAB and GHIAS.

One of ordinary skill in the art would have been motivated to do this modification so that the database may be search for a matching music track according to the representations of the peaks and valleys of the inputted audio/music.

34. **As per independent claim 16**, BLUM, in combination with MCNAB and GHIAS, discloses:

A method of creating a query keyword from an acoustic input for retrieval of music information in a music score database {See GHIAS, p. 4, Para. 5-11, wherein this reads over "[s]ongs in the database are preprocessed to convert the melody into a stream of U, D, S characters, and the converted user input is compared with all the songs"}, the method comprising:

representing the acoustic input in a digital representation in accordance with a representing method, wherein the representing method is adapted to represent audio/musical information in a digital representation suitable for use in content-based information indexing and retrieval {See MCNAB, p. 4, Paras. 3 and 4, wherein this reads over "MIDI note representations", "[s]ince musical units – octaves, cents and so forth – are relative measures" and "MIDI (Musical Instruments Digital Interface) is a standard for controlling and communicating with electronic musical instruments"}, wherein the representing method comprises:

determining a first representation including a set of peaks and valleys corresponding to maximum and minimum values respectively of at least one characteristic of the audio/music {See BLUM, Figure 4; col. 6, lines 24-28, wherein this reads over "[t]he analysis method will compute new arrays of data values (called trajectories), specifying . . . pitch"; and col. 9, lines 1-41, wherein this reads over "[t]he magnitude spectrum is analyzed to find the peaks"}; and

determining a second representation including values representing relative differences between the determined peaks and valleys, wherein the audio/musical information is an acoustic signal {See BLUM, col. 8, wherein this reads over "PITCH-TRAJECTORY CLEANUP routine will look over the entire pitch trajectory and smooth the data while removing bad data points"}.

The combination of inventions disclosed in BLUM, MCNAB, and GHIAS would disclose a method of creating a query keyword from an acoustic input for retrieval of music information in a music score database. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the above invention suggested by BLUM by combining it with the inventions disclosed by MCNAB and GHIAS.

One of ordinary skill in the art would have been motivated to do this modification so that query keywords may be used to retrieve music information representing the peaks and valleys of an acoustic signal.

35. **As per independent claims 19 and 25**, BLUM, in combination with MCNAB and GHIAS, discloses:

A method of converting a music score into score keywords, comprising:

a) preprocessing a score curve so as to remove zero notes, the score curve including a set of digital values representing musical notes {See MCNAB, p. 9, Para. 1, wherein this reads over "[d]eletion and insertion can be handled by transforming a note to a notional zero-length note, and vice versa"};

b) detecting peaks and valleys of the score curve {See BLUM, Figure 4; col. 6, lines 24-28, wherein this reads over "[t]he analysis method will compute new arrays of data values (called trajectories), specifying . . . pitch"; and col. 9, lines 1-41, wherein this reads over "[t]he magnitude spectrum is analyzed to find the peaks"};

c) calculating the distance between each peak/valley and valley/peak pair {See BLUM, col. 6, line 24-28, wherein this reads over "The analysis method will compute new arrays of data values (called trajectories), specifying the amplitude"}; and

d) using the peaks and valleys as reference points, and a note histogram of the peaks and valleys to serve as score keywords {See YOURLO, Figures 11 and 12; col. 8, lines 58-63, wherein this reads over "represented in the form of a histogram covering the entire period of interest for the signal being considered"; and col. 9, lines 46-48, wherein this reads over "[f]rom these resulting pitches, a histogram of dominant pitches present in the original music is formed"}.

The combination of inventions disclosed in BLUM, MCNAB, and GHIAS would disclose a method of converting a music score into score keywords by using the peaks and valleys as reference points. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the above invention suggested by BLUM by combining it with the inventions disclosed by MCNAB and GHIAS.

One of ordinary skill in the art would have been motivated to do this modification so that score keywords may be used in searching the music score database.

36. **Claims 15 and 21** are rejected under 35 U.S.C. 103(a) as being unpatentable over BLUM, in view of MCNAB and GHIAS, and in further view of YOURLO.

BLUM teaches the limitations of claims 1, 8, and 13 for the reasons stated above.

BLUM, GHIAS, and MCNAB teach the limitations of claim 14 for the reasons stated above.

BLUM differs from the claimed invention in that BLUM fails to disclose a method for creating an index for storage with the database (claim 15).

BLUM differs from the claimed invention in that BLUM fails to disclose a method for automatically converting acoustic input in the for of humming into query keywords (claim 21).

37. **As per dependent claim 15**, BLUM, in combination with MCNAB, GHIAS, and YOURLO, discloses:

A method further including:

creating at least one index for storage with the database {See MCNAB, p. 7, Para. 3, wherein this reads over "an index of melodies based entirely on the sequence of interval directions, which is called the 'melodic contour' or 'pitch profile'"},

the at least one index including a global feature corresponding to an entire music score {See MCNAB, p. 7, Para. 2, wherein this reads over "string matching on the score database in order to retrieve music"} wherein the global feature includes the histogram {See YOURLO, Figures 11 and 12; col. 8, lines 58-63, wherein this reads over "represented in the form of a histogram covering the entire period of interest for the signal being considered"; and col. 9, lines 46-48, wherein this reads over "[f]rom these resulting pitches, a histogram of dominant pitches present in the original music is formed"} of the second representation {See GHIAS, p. 4, Para. 5-11, wherein this reads over "[s]ongs in the database are preprocessed to convert the melody into a stream of U, D, S characters, and the converted user input is compared with all the songs"}.

The combination of inventions disclosed in BLUM, MCNAB, GHIAS, and YOURLO would disclose a method for creating an index in a database, wherein the index includes a global feature corresponding to a music score. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the above invention suggested by BLUM by combining it with the inventions disclosed by MCNAB, GHIAS, and YOURLO.

One of ordinary skill in the art would have been motivated to do this modification so that the index may be accessed in the search process.

38. **As per independent claim 21**, BLUM, in combination with GHIAS, MCNAB, and YOURLO, discloses:

A method of automatically converting acoustic input in the form of humming into query keywords {See GHIAS, p. 2, Para. 3, wherein this reads over "how user input to the system (humming) is converted into a sequence of relative pitch transitions}, comprising:

a) converting the acoustic input into digital signal {See GHIAS, Figure 1; and p. 2, Para. 1, wherein this reads over "[q]ueries are hummed into a microphone, digitized, and fed into a pitch-tracking module"};

b) detecting the pitch from the digital signal {See GHIAS, Equations 1 and 2; p. 2, Para. 2, wherein this reads over "[p]itch tracking is performed in Matlab, chosen for its built-in audio processing capabilities and the ease of testing a number of algorithms"; and Paras. 3-8};

c) converting the pitch into notes {See MCNAB, p. 4, Paras. 3 and 4, wherein this reads over "MIDI note representations", "[s]ince musical units – octaves, cents and so forth – are relative measures" and "MIDI (Musical Instruments Digital Interface) is a standard for controlling and communicating with electronic musical instruments"};

d) representing the acoustic input by a pitch curve {See GHIAS, Figure 2};

e) smoothing of the pitch curve by removing small peaks and valleys {See FOOTE, col. 3, line 65 – col. 4, line 9, wherein this reads over "each analysis frame is windowed with a 256-point Hamming window and a Fast Fourier transform is used for parameterization to estimate the spectra components in the window. The logarithm of the magnitude of the result of the FFT is used as an estimate of the power spectrum of the signal in the window"};

f) detecting peaks and valleys of the pitch curve {See BLUM, Figure 4; col. 6, lines 24-28, wherein this reads over "[t]he analysis method will compute new arrays of data values (called trajectories), specifying . . . pitch"; and col. 9, lines 1-41, wherein this reads over "[t]he magnitude spectrum is analyzed to find the peaks"}; and

g) generating the query keywords using the peaks and valleys in accordance with a method {See GHIAS, p. 4, Para. 5-11, wherein this reads over "[s]ongs in the database are preprocessed to convert the melody into a stream of U, D, S characters, and the converted user input is compared with all the songs"}, wherein the method comprises

calculating the distance between each peak/valley and valley/peak pair {See BLUM, col. 6, line 24-28, wherein this reads over "The analysis method will compute new arrays of data values (called trajectories), specifying the amplitude"}; and

using the peaks and valleys as reference points, and a note histogram of the peaks and valleys to serve as score keywords {See YOURLO, Figures 11 and 12; and col. 9, lines 46-48, wherein this reads over "[f]rom these resulting pitches, a histogram of dominant pitches present in the original music is formed"}.

The combination of inventions disclosed in BLUM, MCNAB, GHIAS and YOURLO would disclose a method of automatically converting acoustic input in the form of humming into query keywords. Therefore, it would have been obvious to one of ordinary skill in the art at the

time the invention was made to modify the above invention suggested by BLUM by combining it with the inventions disclosed by MCNAB, GHIAS, and YOURLO.

One of ordinary skill in the art would have been motivated to do this modification so that a user may hum in an acoustic input, which may be then analyzed and converted into query keywords.

39. **Claims 18 and 24 are** rejected under 35 U.S.C. 103(a) as being unpatentable over MCNAB, in view of GHIAS.

MCNAB differs from the claimed invention in that MCNAB fails to disclose a method for using a curve including a set of digital values to represent the music score information (claims 18 and 24).

40. **As per independent claims 18 and 24**, MCNAB, in combination with GHIAS, discloses:

A method of creating a music score database, comprising:

a) using a music score to uniquely represent an actual music song such that there is a link provided between a music score database and a music database {See MCNAB, p. 7, Para. 2, wherein this reads over "string matching on the score database in order to retrieve music"};

b) using a curve including a set of digital values to represent the music score information {See GHIAS, Figures 1-3}; and

c) using peaks and valleys of the curve so as to index the music score database {See GHIAS, p. 4, Para. 5-11, wherein this reads over "[s]ongs in the database are preprocessed to convert the melody into a stream of U, D, S characters, and the converted user input is compared with all the songs"}.

The combination of inventions disclosed in MCNAB and GHIAS would disclose a method of creating a music score database. Therefore, it would have been obvious to one of

ordinary skill in the art at the time the invention was made to modify the above invention suggested by MCNAB by combining it with the invention disclosed by GHIAS.

One of ordinary skill in the art would have been motivated to do this modification so that music score information may be indexed according to the peaks and valleys of the audio input.

41. **Claim 20** is rejected under 35 U.S.C. 103(a) as being unpatentable over MCNAB, in view of YOURLO and VARME.

MCNAB teaches the limitations of claim 20 for the reasons stated below.

MCNAB differs from the claimed invention in that MCNAB fails to disclose a method of using digital values to represent music score information and constructing histograms (claim 20).

42. **As per independent claim 20**, MCNAB, in view of YOURLO and VARME, discloses:

A method of creating indexes to organise a music score database created in accordance with a method, comprising:

constructing a global feature for the complete actual music song, wherein the global feature is the histogram of the values of the distances between each peak/valley and valley/peak pair {See YOURLO, Figures 11 and 12; col. 8, lines 58-63, wherein this reads over "represented in the form of a histogram covering the entire period of interest for the signal being considered"; and col. 9, lines 46-48, wherein this reads over "[f]rom these resulting pitches, a histogram of dominant pitches present in the original music is formed"},

wherein the music score database creating method comprises:

using a music score to uniquely represent an actual music song such that there is a link provided between a music score database and a music database {See MCNAB, p. 7, Para. 2, wherein this reads over "string matching on the score database in order to retrieve music"};

using a curve including a set of digital values to represent the music score information {See VARME, col. 2, lines 20-22, wherein this reads "musical notation system for creating colored music scores and colored musical instruments"; and col. 2, lines 41-45, wherein this reads over "music score includes notes which form a musical arrangement"}; and

using peaks and valleys of the curve so as to index the music score database {See MCNAB, p. 7, Para. 3, wherein this reads over

> "[w]hat attributes should be used when searching a musical score database?", "conducting the search on the basis of pitch ratios, or musical intervals", and "an index of melodies based entirely on the sequence of interval directions, which is called the 'melodic contour' or 'pitch profile'"}.

The combination of inventions disclosed in MCNAB, YOURLO, and VARME would disclose a method of creating indexes to organize a music score database. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the above invention suggested by BLUM by combining it with the inventions disclosed by MCNAB, YOURLO, and VARME.

One of ordinary skill in the art would have been motivated to do this modification so that a music score database may be created using the peaks and valley of the audio input curve.

43. **Claim 22** is rejected under 35 U.S.C. 103(a) as being unpatentable over GHIAS, in view of YOURLO and FRANCU.

GHIAS teaches the limitations of claim 22 for the reasons stated below.

GHIAS differs from the claimed invention in that GHIAS fails to disclose a method wherein the global feature is a histogram, and wherein the note histogram is matched by intersection (claim 22).

44. **As per independent claim 22**, GHIAS, in view of YOURLO and FRANCU, discloses:

> A method of matching query keywords with music score keywords, comprising:
>
> > a) checking a global feature for the complete actual music song, wherein the global feature is the histogram of the values of the distances between each peak/valley and valley/peak pair {See YOURLO, Figures 11 and 12; col. 8, lines 58-63, wherein this reads over "represented in the form of a histogram covering the entire period of interest for the signal being considered"; and col. 9, lines 46-48, wherein this reads over "[f]rom these resulting pitches, a histogram of dominant pitches present in the original music is formed"};
>
> > b) matching the sequence of peak/valley distance values of the query and the peak/valley distance values of the music score keywords {See GHIAS, p. 4, Para. 5-11, wherein this reads over "[s]ongs in the database are

preprocessed to convert the melody into a stream of U, D, S characters, and the converted user input is compared with all the songs"}; and.

c) matching the note histogram by histogram intersection {See FRANCU, Figure 2; and p. 890-891}.

The combination of inventions disclosed in GHIAS, YOURLO, and FRANCU would disclose a method of matching query keywords with music score keywords. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the above invention suggested by GHIAS by combining it with the inventions disclosed by YOURLO and FRANCU.

One of ordinary skill in the art would have been motivated to do this modification so that matches may be retrieved by histogram intersection.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Paul Kim whose telephone number is (571) 272 2737. The examiner can normally be reached on M-F, 9am - 5pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Safet Metjahic can be reached on (571)272-4023. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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